* =mandatory field)

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- **Dataset_Info**:*
  - Dataset_ID*: KEO_145E_32N_Sep2009_Sep2010
  - **Submission_Dates**:*
    - Initial_Submission: 20100821 (YYYYMMDD)
    - Revised_Submission: (YYYYMMDD)
- **Cruise_Info**:*
  - **Experiment**:
    - Experiment_Name*:
    - **Cruise**:**(-)**
      - Cruise_ID: (EXPOCODE)
      - Section: (Leg)
      - **Geographical_Coverage**:*
        - Geographical_Region:
        - **Bounds**:
          - Westernmost_Longitude:
            Enter decimal fractions of degrees:
            or Degrees, Minutes, Seconds:
          - Easternmost_Longitude:
            Enter decimal fractions of degrees: +144.54 (+ = E, - = W)
            or Degrees, Minutes, Seconds:
          - Northernmost_Latitude:
            Enter decimal fractions of degrees:+ 32.30 (+ = E, - = W)
          - Southernmost_Latitude:
            Enter decimal fractions of degrees:
      - **Temporal_Coverage**:
        - Start_Date: 20090905 (YYYYMMDD)
        - End_Date: 20100944 (YYYYMMDD)
  - **Vessel**:* Mooring platform
    - Vessel_Name:
    - Vessel_ID:
    - Country:
    - Vessel_Owner:
- **Variables_Info**:*
  - **Variable**:
    - Variable_Name and Description*:
- Date Time – in UTC
- xCO_2 SW (wet) (umol/mol) - Mole fraction of CO_2 in air in equilibrium with the seawater at sea surface temperature and measured humidity.
- CO2 SW QF – Quality Flag for xCO_2 SW (wet).
- H_2O SW (mmol/mol) - Mole fraction of H_2O in air from equilibrator .
- xCO_2 Air (wet) (umol/mol) - Mole fraction of CO_2 in air from airblock, 4 feet above the sea surface at measured humidity.
- CO2 Air QF – Quality Flag for xCO_2 Air (wet)

- H_2O Air (mmol/mol) - Mole fraction of H_2O in air from airblock, 4 feet above the sea surface.
- Licor Atm Pressure (hPa) – Atmospheric pressure at the airblock, 4 feet above the sea surface
- Licor Temp (C) – Temperature of the Infrared Licor 820 in degrees Celsius
- % O_2 - The percent oxygen of the surface seawater divided by the percent oxygen of the atmosphere at 4 feet above the sea surface. Disclaimer: The oxygen measurement is made in the equilibrated air. We have found that the oxygen does not come to complete equilibrium so any rapid changes in oxygen do not get properly captured using this system. Therefore, we tend to use the oxygen data only as a qualitative sense of the biology. It is not a quantitative measure.
- SST (C) - Sea Surface Temperature collected by NOAA/PMEL/KEO. provide internally recorded SST data at 10 minute resolution. The sea surface temperature collected during the equilibration period is reported in this dataset. NOAA/PMEL/KEO advises to check the KEO site at the time of use for the most accurate data available.
- Salinity - Sea Surface Salinity collected by NOAA/PMEL/KEO. KEO records conductivity data at 10 minute intervals and then computes hourly averaged salinity during post-processing. The salinity reported during the equilibration period is reported in this dataset. NOAA/PMEL/KEO advises to check the KEO site at the time of use for the most accurate data available.
- xCO_2 SW (dry) (umol/mol) – Mole fraction of CO_2 in air in equilibrium with the seawater at sea surface temperature (dry air).
- xCO_2 Air (dry) (umol/mol) – Mole fraction of CO_2 in air at the airblock, 4 feet above the sea surface (dry air).
- fCO_2 SW (sat) uatm – Fugacity of CO_2 in air in equilibrium with the seawater at sea surface temperature (100% humidity). Since the measurements are taken at the sea surface, warming calculations are not necessary.
- fCO_2 Air (sat) uatm – Fugacity of CO_2 in air at the airblock, 4 feet above the sea surface (100% humidity).
- $dfCO_2$ – Difference of the fugacity of the CO_2 in seawater and the fugacity of the CO_2 in air (fCO_2 SW - fCO_2 Air).

- **Method_Description**:*
  - **Equilibrator_Design**:
    - Equilibrator_Type: (show pick list) Bubble Equilibrator
    - Equilibrator_Volume: (L) N/A
    - Water_Flow_Rate: (L/min) N/A
    - Headspace_Gas_Flow_Rate: (L/min) ~600 cc/min
    - Vented: (show pick list) Yes
  - Measurement_Method: Absolute, non-dispersive infrared (NDIR) gas analyzer
  - Manufacturer_of_Calibration_Gas: NOAA Earth System Research Laboratory (ESRL)
  - **CO_2_Sensors**:
    - **CO_2_Sensor**:
      - Manufacturer: Licor
      - Model: Environmental_Control: LI-820
      - Resolution: 0.01 ppm
      - Uncertainty: < 2.5% of reading with 14 cm bench (stated) <1.5 ppm determined in lab
      - CO_2_Sensor_Calibration: (For each calibration gas, document traceability to an internationally recognized scale, including date and place of last calibration. Include uncertainty of assigned value.)

        At the beginning of each sample, the instrument self-calibrates using a zero and high standard. The zero standard is generated by cycling a small amount

of air through a soda lime chamber. The high standard is from a cylinder of calibrated standard reference gas, 408.63 umol/mol, from ESRL. ESRL standards are traceable to WMO x93 scale with a stated reproducibility of 0.06 micromole/mole.

- **Other_Sensors**: Oxygen Sensor
  - Manufacturer: Maxtec
  - Model: Max-250
  - Resolution: 0.01 %
  - Uncert-ainty: ± 2.0% Full Scale over operating temperature range
    ± 1.0% Full Scale @ constant temperature and pressure
  - Calibration: (For each sensor of pressure, temperature, and salinity, document traceability to an internationally recognized scale, including date and place of last calibration.)
    Factory calibrated before purchase. Recalibrated to sea level atmospheric air every 7 days.

- **Other_Sensors**: Humidity Sensor
  - Manufacturer: Sensirion
  - Model: SHT71
  - Resolution: 0.01 %
  - Uncertainty: Measurement range: 0-100% RH
    Absolute. RH accuracy: +/- 3% RH (20-80% RH)
    Repeatability RH: +/- 0.1% RH
  - Calibration: (For each sensor of pressure, temperature, and salinity, document traceability to an internationally recognized scale, including date and place of last calibration.)
    Factory calibrated before purchase.

- Method_References: (Publication(s) describing method)

Sabine, C. (2005): High-resolution ocean and atmosphere pCO_2 time-series measurements. The State of the Ocean and the Ocean Observing System for Climate, Annual Report, Fiscal Year 2004, NOAA/OGP/Office of Climate Observation, Section 3.32a, 246–253.

- Additional Information

- All measurements are at sea surface temperature and atmospheric pressure.

- During the equilibration cycle, a closed loop of air equilibrates with seawater for 10 minutes. Once the equilibration period is complete, the pump stops and the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged.

- During the air cycle, fresh air is pumped through the detector for 1 minute. Once the pump stops, the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged.

- The gas streams for both the air cycle and equilibrator cycle are partially dried before entering the detector. The values listed as wet xCO_2 generally have relative humidity levels ranging from 40 to 80 percent. The humidity levels increase over the course of a deployment.

- Sampling occurs every 3 hours. The infrared detector is calibrated at the beginning of every sampling period. Averaged data and standard deviations for each measurement are transmitted back daily.

- To calculate the dry measurements, the water mole fraction in the Licor detector must be known. A relative humidity sensor is located immediately downstream of the detector.

- As part of the QC process, each data set is compared with the Marine Boundary Layer (MBL) data from GlobalView-CO_2. The data from this deployment, September 2009 to September 2010, were -1.3 ± 2.0 umol/mol on average of the MBL data and therefore no correction was applied.

GLOBALVIEW-CO_2: Cooperative Atmospheric Data Integration Project - Carbon Dioxide. CD-ROM, NOAA ESRL, Boulder, Colorado [Also available on Internet via anonymous FTP to ftp.cmdl.noaa.gov, Path: ccg/co2/GLOBALVIEW], 2010

-During the QC process, an adjustment to the Licor pressure is also made based on each sensor's bias to barometric pressure as measured in the lab. For this system, there was no Licor pressure bias.

- No data = -9.999 or -999

- Data_set_References: (Publication(s) describing data set) None

- Citation: (How to cite this data set) Sutton, A.J, C. Sabine, and S. Maenner. 2012. High-resolution ocean and atmosphere pCO2 time-series measurements from mooring KEO.
- **Data_Set_Link**:
  - URL*: http://www.pmel.noaa.gov/co2/story/KEO
  - Label*:PMEL CO2 Group - KEO mooring
  - Link_Note: (Optional instructions or remarks)**(m s t)**

Quality Flags definitions:

2 = Acceptable measurement;
3 = Questionable measurement;
4 = Bad measurement
5 = Not reported;
9 = Sample not drown for this measurement from this bottle.

Quality Flag Log for this dataset.

Date	Measurement	Value (Dry)	Flag	Comments
9/8/2009 18:17	xCO2_SW	420.3265739	3	questionable sw CO2 data due to pressure problems during equilibrator cycle
9/8/2009 21:17	xCO2_SW	417.7720877	3	questionable sw CO2 data due to pressure problems during equilibrator cycle
9/19/2009 12:17	xCO2_SW	403.0035182	3	questionable sw CO2 data due to pressure problems during equilibrator cycle
9/19/2009 15:17	xCO2_SW	435.9198974	3	questionable sw CO2 data due to pressure problems during equilibrator cycle
9/19/2009 18:17	xCO2_SW	427.6941556	3	questionable sw CO2 data due to pressure problems during equilibrator cycle
9/19/2009 21:17	xCO2_SW	428.6504313	3	questionable sw CO2 data due to pressure problems during equilibrator cycle
9/20/2009 0:17	xCO2_SW	395.9811335	3	questionable sw CO2 data due to pressure problems during equilibrator cycle
10/26/2009 21:17	xCO2_SW	422.6001798	4	bad sw CO2 data due to pressure problems during equilibrator cycle
11/2/2009 9:17	xCO2_SW	393.4154824	4	bad sw CO2 data due to problem during equlibrator cycle
11/13/2009 18:17	xCO2_SW	216.2434646	4	bad sw CO2 data due to calibration problem during this run

11/13/2009 18:17	xCO2_Air	301.2317742	4	bad air CO2 data due to calibration problem during this run
12/19/2009 21:17	xCO2_SW	342.4705097	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
12/19/2009 21:17	xCO2_Air	389.7989274	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
12/22/2009 12:17	xCO2_SW	331.6630949	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
12/22/2009 12:17	xCO2_Air	390.0229604	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
12/31/2009 9:17	xCO2_SW	358.813437	4	bad sw CO2 data due to pressure problems during equilibrator cycle
1/13/2010 3:17	xCO2_SW	345.7171198	4	bad sw CO2 data due to problem during equlibrator cycle
1/21/2010 3:17	xCO2_SW	343.3816357	4	bad sw CO2 data due to pressure problems during equilibrator cycle
2/24/2010 12:17	xCO2_SW	336.0743711	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
2/24/2010 12:17	xCO2_Air	392.6495593	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
2/26/2010 12:17	xCO2_SW	326.0431209	3	CO2 data submitted was adjusted by - 21 ppm b/c span calibration was off as predicted by change in Licor temperature
2/26/2010 12:17	xCO2_Air	412.1556764	3	CO2 data submitted was adjusted by - 21 ppm b/c span calibration was off as predicted by change in Licor temperature
3/3/2010 12:17	xCO2_SW	345.9257942	3	CO2 data submitted was adjusted by - 21 ppm b/c span calibration was off as predicted by change in Licor temperature
3/3/2010 12:17	xCO2_Air	415.6199243	3	CO2 data submitted was adjusted by - 21 ppm b/c span calibration was off as predicted by change in Licor temperature
3/18/2010 15:17	xCO2_SW	339.4111383	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
3/18/2010 15:17	xCO2_Air	372.264966	3	CO2 data submitted was adjusted by + 21 ppm b/c span calibration was off as predicted by change in Licor temperature
3/28/2010 18:17	xCO2_SW	327.1869853	3	CO2 data submitted was adjusted by - 22 ppm b/c span calibration was off as predicted by change in Licor temperature
3/28/2010 18:17	xCO2_Air	393.4244294	3	CO2 data submitted was adjusted by - 22 ppm b/c span calibration was off as predicted by change in Licor temperature
6/6/2010 9:17	xCO2_SW	367.3730251	3	CO2 data submitted was adjusted by - 11 ppm b/c span calibration was off as predicted by change in Licor temperature
6/6/2010 9:17	xCO2_Air	388.6111221	3	CO2 data submitted was adjusted by - 11 ppm b/c span calibration was off as predicted by change in Licor temperature
6/15/2010 9:17	xCO2_SW	169.1214455	4	bad sw CO2 data due to calibration problem during this run
6/15/2010 9:17	xCO2_Air	323.953169	4	bad air CO2 data due to calibration problem during this run
8/8/2010 18:17	xCO2_SW	451.9777198	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/8/2010 21:17	xCO2_SW	503.6038582	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/9/2010 0:17	xCO2_SW	512.8076172	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/9/2010 3:17	xCO2_SW	524.4927812	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/9/2010 6:17	xCO2_SW	552.6450885	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/9/2010 9:17	xCO2_SW	557.2340612	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/9/2010 12:17	xCO2_SW	502.6297432	4	bad sw CO2 data due to pressure problems during equilibrator cycle

8/9/2010 15:17	xCO2_SW	529.4172397	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/9/2010 18:17	xCO2_SW	543.7330508	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/9/2010 21:17	xCO2_SW	540.7963127	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 0:17	xCO2_SW	427.0185782	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 3:17	xCO2_SW	478.1178547	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 6:17	xCO2_SW	511.2797705	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 9:17	xCO2_SW	510.6749044	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 12:17	xCO2_SW	484.1230683	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 15:17	xCO2_SW	484.2389926	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 18:17	xCO2_SW	482.1333395	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/10/2010 21:17	xCO2_SW	517.2946273	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 0:17	xCO2_SW	547.6460557	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 3:17	xCO2_SW	585.8885303	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 6:17	xCO2_SW	629.260769	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 9:17	xCO2_SW	629.7825528	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 12:17	xCO2_SW	622.7231024	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 15:17	xCO2_SW	611.0692011	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 18:17	xCO2_SW	608.238122	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/11/2010 21:17	xCO2_SW	593.0929506	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/12/2010 0:17	xCO2_SW	614.1334411	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/12/2010 3:17	xCO2_SW	584.0186336	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/12/2010 6:17	xCO2_SW	449.273706	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/12/2010 9:17	xCO2_SW	499.9720063	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/27/2010 9:17	xCO2_SW	519.0941454	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/27/2010 12:17	xCO2_SW	519.3235914	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/27/2010 15:17	xCO2_SW	525.2291104	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/27/2010 18:17	xCO2_SW	544.0456546	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/27/2010 21:17	xCO2_SW	595.2144164	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/28/2010 0:17	xCO2_SW	637.2619282	4	bad sw CO2 data due to pressure problems during equilibrator cycle

8/28/2010 3:17	xCO2_SW	667.269509	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/28/2010 6:17	xCO2_SW	716.563919	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/28/2010 9:17	xCO2_SW	738.0704857	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/28/2010 12:17	xCO2_SW	749.8437519	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/28/2010 15:17	xCO2_SW	721.9153042	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/28/2010 18:17	xCO2_SW	721.1631486	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/28/2010 21:17	xCO2_SW	733.458803	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 0:17	xCO2_SW	785.1216935	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 3:17	xCO2_SW	824.6947795	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 6:17	xCO2_SW	861.2435152	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 9:17	xCO2_SW	847.2845533	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 12:17	xCO2_SW	842.7940321	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 15:17	xCO2_SW	823.60937	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 18:17	xCO2_SW	801.4423188	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/29/2010 21:17	xCO2_SW	799.3844492	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 0:17	xCO2_SW	808.1040845	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 3:17	xCO2_SW	802.0351694	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 6:17	xCO2_SW	843.7917967	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 9:17	xCO2_SW	833.6285889	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 12:17	xCO2_SW	840.0970616	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 15:17	xCO2_SW	840.6041594	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 18:17	xCO2_SW	833.7016717	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/30/2010 21:17	xCO2_SW	846.1739835	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/31/2010 0:17	xCO2_SW	863.3146624	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/31/2010 3:17	xCO2_SW	875.5798545	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/31/2010 6:17	xCO2_SW	730.4704461	4	bad sw CO2 data due to pressure problems during equilibrator cycle
8/31/2010 9:17	xCO2_SW	685.3784676	4	bad sw CO2 data due to pressure problems during equilibrator cycle